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Coupled Electrokinetic-Bioremediation: Principles, Applications and Perspective

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Microbes are found to be able to biodegrade almost all organic chemicals that have been discovered or produced to date. Bioremediation is considered to be a cost effective approach for in situ remediation of soils and groundwater polluted by organic contaminants. Unlike under ideal conditions controlled in the laboratories, however, in situ bioremediation is generally constrained by many factors, like geological, hydro-geological, physical, geochemical, and/or biological conditions. These constraints may decrease the efficiency of bioremediation and/or lead to slow or incomplete biodegradation of contaminants.

To accelerate or stimulate in situ bioremediation of organic contaminants, some physical, chemical, and/or biological approaches can be coupled to the bioremediation. Since electrokinetics can control the flow of ions and groundwater through the soil and can manipulate pH and redox, it can be a strong candidate for coupling to bioremediation.

In this presentation, we briefly overview the principles associated with electrokinetic-bioremediation, illustrate potentials and advantages of this integrated method, introduce selected examples of application, summarize practical considerations and limitations of the method, and indicate perspective of this technology. Our investigation illustrated that although there is significant potential for the application of this technology, many development works are still necessary for achieving wide acceptance and practical application. The use of natural energies, like solar energy and/or wind power may increase the total cost efficiency of this technology.

Keywords: Electrokinetics, Bioremediation, Integration, Contemporary overview, Perspective